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ABSTRACT

This report on research in progress explores criteria for lexical innovation in children. Children, like adults, make use of a principle of conventionality (each word has one or more conventional meanings) and one of contrast (the conventional meanings of every two words contrast). Like adults, children coin words to fill lexical gaps, and they do so according to certain principles that are reflected by apparent strategies: (1) one-to-one matches of meaning and form are easier to acquire than one-many or many-one matches ("Look for word-formation devices that are words in their own right and use those in constructing new words."): (2) simpler forms are easier to acquire than more complex ones, where simplicity is measured by degree of change in form ("Make as few changes as possible in forming a new word from an old one."): (3) the paradigms of a language are regular in form ("Use the same word-formation device everywhere to mark the same meaning in forming new words."): and (4) the most creative adult word-formation devices are the most productive, and the most available to children ("Look for the commonest device that expresses the desired meaning and use that in constructing a new word-form." (JB)

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CONVENTION AND INNOVATION IN ACQUIRING THE LEXICON*

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Introduction

The more I have worked on children's acquisition of vocabulary, the more concerned I have become with two major principles governing the lexicon. The first--that words have conventional meanings--I will call the principle of conventionality. And the second--that words differ in meaning--I will call the principle of contrast. Let me illustrate the workings of these two principles: Imagine you were constructing a dictionary for some new language. After collecting notes on words and their meanings, you would organize them by putting the first word on the left of your page, say, with its conventional meanings on the right, the second word and its conventional meanings below the first, and so on down the page till it was filled. The principle of conventionality captures the fact that each word you listed has one or more conventional meanings. Notice also that the second meaning differs from the first, and that the third differs from both the first and the second, and so on down the page. The principle of contrast captures the fact that every meaning of every word you listed differs from the other meanings. In the present paper, I will argue that the acquisition and growth of a vocabulary is much like the construction of a dictionary: what is continually being added are conventional meanings that contrast with the meanings already available.

Consider growth in the lexicon, and why it occurs. First, lexical growth for adults comes from novel coinages, innovative lexical items constructed just for the occasion to carry a particular meaning. These coinages get constructed, I have argued, to supply words where there are none with those exact meanings already available in the language (e.g., Clark & Clark, 1979; Clark, 1979). To illustrate this, I have listed some typical adult innovations (heard in the last few weeks), together with a gloss of the meaning intended on each occasion, in Table 1. These

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"new" lexical items include some new verbs formed from nouns, some new nouns formed from other nouns or formed by adding an ending to some existing noun, and some new adjectives and adverbs.

Table 1

Some Typical, Recently-Overheard, Adult Innovations
and their "Occasion" Meanings

New verbs:

i) . . . unless I interlibrary-loaned it already. ("wrote to interlibrary loan about a particular book")

ii) They grandfather. ("write in special exemption clauses in new tax legislation")

iii) It's all gated. (of a new apartment, "protected by gates")

iv) I really charcoaled the potatoes. (" burnt by allowing the pan to boil dry")

New nouns:

v) What do you think about this Congressgate? (opening gambit at lunch, "the scandal over Members of Congress accepting bribes")

vi) He's an avid tenter. (" likes to stay in a tent when on holiday")

vii) With the complexification of society . . . (" with the making more complex")

New adjectives and adverbs:

viii) It's griceable. (" could be understood using the principles of cooperative conversation described by the philosopher Grice")

ix) And oppositely. ("vice versa," or "the other way round")

Adults, though, are not the only speakers to coin new words to add to the stock of vocabulary normally available. Young children coin new words too, and do so frequently. To give some idea of the range of innovations children produce before age five, I have listed some typical examples in Table 2--new verbs, new nouns, and new adjectives, together with their intended meanings.

Table 2

Some Typical Child Innovations and their "Occasion" Meanings
from Two- to Five-year olds

New verbs:

to babysitter (= act as a babysitter to); to broom$_1$ (= hit with a broom); to broom$_2$ (= sweep); to cello (= play the cello); to cement (= make cement); to cracker (= put crackers into); to fire (= burn); to hair (= brush hair); to needle (= mend); to scale (= weigh); to stick (= hit with a stick); to string up (= do up a bead-and-string fastening for a cowboy hat); to trousers (= put trousers on), etc.

New nouns:

a bang (= gun); a decorate (= decoration); the shave (= lather); the lessoner (= teacher); a driller (= drill); angriness (= anger); iron-man (= pots-and-pans mender); letter-man (= mailman); cup-egg (= boiled egg); door-feather (= feather stuck in the screen door), etc.

New adjectives:

a pointy stick (= stick with a pointed end); a runny dog (= dog that runs around a lot); a fitting chair (= chair the right size, for the child); farer (= farther); salter (= more salty); bestest (= best), etc.

My first aim in this paper will be to consider the roles of conventionality and contrast in the acquisition of vocabulary by looking at children's lexical innovations, their coinages. The reason for focussing on their coinages rather than on well-established lexical items is that the contributions of these two principles is particularly apparent in the formation of new words. (This, of course, is true of adults as well.) But since conventionality and contrast on their own make few or no predictions about the course of acquisition children follow in forming new words, my second aim is to identify some of the principles that do make predictions about the acquisition process itself. And in doing this, I will look at how conventionality and contrast pervade the acquisition principles as well.

Before I take up conventionality and contrast, I would like to remind you of a few "brute facts" about vocabulary acquisition, and in particular about the amount of vocabulary children master in their first few years (Templin, 1957):

(1) By the age of six, the average child is estimated to have learned some 14,000 words;

(2) If that child begins to acquire this vocabulary at the age of eighteen months, he must learn at least nine new words a day;

(3) In addition, that child is at the same time mastering the sound system (the segments, stress patterns, and intonation contours), the syntactic rules for combining words, the conventions of use for words and for word-combinations, and, I will argue, at least some of the word-formation options available in the language.

Acquiring a vocabulary, then, while only part of what children acquire in their first years of language learning, is no negligible task.

The Principles of Conventionality and Contrast

As adult speakers, we take for granted that we must use the conventional words for things if we are to make ourselves understood by our addressees. For example, we would think it only reasonable to use the word horse to denote members of the category HORSE, or the word sit to denote actions of SITTING, or the conjunction if to indicate conditionality, and so on. And we would therefore not be at all surprised if we failed to make ourselves understood, having unilaterally decided to use the term horse to express negation, or if to denote porcupines. The principle behind these assumptions can be stated as follows:

Principle of Conventionality: Each word (or word-formation device) has one or more conventional meanings in a language community.

Observing this principle leads us, as speakers, to use the following strategy:

"Find the word or device that is conventionally used to express the requisite meaning."

The principle of conventionality has as its direct corollary the principle of contrast. This principle can be stated as follows:

Principle of Contrast: The conventional meanings of every two words (or word formation devices) contrast.

Just as well-established terms within the vocabulary contrast with each other, so new words -- coinages -- must also contrast with each other and with words already in the language.

Let me illustrate this by considering the case of verbs derived from nouns. This process is a very common one in English, as we can see from pairs like a bicycle/to bicycle, a house/to house, etc. By the principle of contrast, two verbs formed from the same noun must contrast in meaning. Some examples already well-established in the language are enlist (to enroll in some organization) versus list (put on a list), both from the noun list. Or the verbs winter (to spend the winter) versus winterize (to make winter-proof), both from the noun winter. Equally, when it comes to coining new verbs, one cannot form a new verb where there already exists a verb with the required meaning. Thus, because of to hospitalize, it's not possible to coin *to hospital with that same meaning, nor, given enthrone, is it possible to coin *to throne with the same meaning. The strategy speakers follow here, in observing the principle of contrast, is:

"Use available words before you construct new ones."

Together the principles of conventionality and contrast capture the facts that (a) for a communication system to work, the conventions or conventional meanings of terms must be consistent from one occasion to the next, and (b) terms must maintain the same contrasts from one occasion to the next.

Conventionality, Contrast, and Children

A major issue for language development is whether and how soon children observe the principles of conventionality and contrast in acquiring vocabulary. My first task, then, is to present the evidence that even very young children rely on these two principles. I will then turn to when and how children construct new words, and the further principles they observe as they do this.

When do children recognize that each word has a conventional meaning in the language? I will argue that there are three kinds of evidence for the principle of conventionality being observed from the start of language use:

(a) The first piece of evidence is that children adopt each adult form and use it consistently from one occasion to the next, with some relation to the adult convention. (In fact, virtually all my previous research has been concerned with children's hypotheses about what that consistency was from one occasion to the next, for instance, what the word dog denotes, or what relations are picked out by words like in, under, here, or that (e.g., Clark, 1973a, 1973b, 1978a).)

The requirement that there be consistency from one occasion to the next in language may be something that children cannot grasp until age one or so. Acquisition of the idea of consistency, marked in language by conventionality of meaning and by meaning contrasts, could place a lower cognitive bound on when children start learning to talk. Until they realize there is consistency, they have no way to "break into" the language being used around them.

(b) The second piece of evidence for conventionality is that young children (from about age two) ask for the names of things. The emergence of intensive question-asking in this vein seems to coincide with two other changes in children's early language use: first, with the addition of new words, they gradually stop over-

extending; and second, they begin refusing to name objects for which they lack words.

(c) The third piece of evidence for conventionality is that children very early make spontaneous corrections--repairs--of their own word choices, again from age two (or even earlier) and thereby give clear evidence of their knowledge of at least some contrasts holding between particular conventional meanings. For example, one two-year-old corrected himself in talking about a rowing-boat by going from the word ship to the word boat, while another slightly older child corrected himself, when talking about putting on footwear, by going from shoe to sandal. Spontaneous lexical repairs of this kind are frequent in children's speech from a very young age (e.g., Clark & Andersen, 1979).

Notice that, logically, assuming the principle of conventionality is not the only option open to children. The conclusion that each word has a conventional meaning that "goes with" the kind of entity or action being picked out is by no means an inevitable one. Logically, the child could as well assume that each word has a different meaning on each occasion. The child would then treat each word as if it was like the demonstrative that. What is important, therefore, about the evidence in (a) through (c) is that it strongly favors children's recognition that conventionality rather than some logical alternative to conventionality is what makes sense of language.

Now let me turn to the principle of contrast. The evidence for it is not easily separable from the evidence for conventionality, since the two principles really go hand-in-hand. However, there is evidence that children realize early that the conventional meanings of words contrast. This evidence comes from two sources: children's narrowing-down of over-extensions (already mentioned in connection with conventionality) and their immediate inferences about the set or domain to which newly-heard words belong.

(a) When children over-extend terms such as their first animal word, they use a word like dog, say, to denote not only dogs but other animals too: sheep, cats, horses, cows, etc. When they add other animal terms to the domain, however, they partition the domain previously covered by dog. The addition of cow, for instance, will split the domain so dog picks out relatively small animals (cats, sheep, and dogs, say) while cow picks out the bigger ones (cows and horses, say). This domain is further split with the addition of cat, sheep, and other animal terms. Notice that children could start out thinking that the word dog was simply a superordinate, and so set up a partial inclusion relation between cow and dog with the addition of cow. But that would leave half the domain without any label at the same level as cow and therefore constitute a gap in the child's taxonomy, as in (i):

Instead, children seem to assume that dog and cow (and subsequent terms added to this domain) apply at the same level, as in (ii), and hence contrast with each other (Clark, 1978b). Such terms then are all hyponyms. Moreover, they are hyponyms

at the basic level in the emerging taxonomy being constructed by the child (e.g., Rosch et al., 1976).

(b) The second piece of evidence for contrast comes from children's inferences about new words. Upon hearing a new word in some setting, children make an immediate inference about the set or group of words it goes with (the domain "on stage" at the time). In spontaneous speech, new words are virtually always assimilated to the right domain (animal terms to the animal domain, for example) and are treated as contrasting with terms already known. There is also evidence for this point in three recent experimental studies of word acquisition. Carey (1978) introduced the word chromium (to pick out "olive green") to nursery school children in the context of asking for "the chromium tray, not the red one." Even those children who failed to learn the exact color denoted treated chromium as a color word contrasting with other color words. This study was followed up by Dockrell (1979, in preparation) who looked more closely at the context in which a new word was introduced. By setting the stage appropriately, she induced one group of children to take the word to be a color term, and a second group to take the same word to be a shape term. The critical factor was the context given by the domain (color versus shape) that was "on stage" when the new word was introduced. What is important about these experimental findings is that the children immediately assumed contrast between the new words and words they already knew.

The principles of conventionality and contrast, then, are observed very early in the acquisition of language. However, neither principle makes any direct predictions about the course of acquisition itself--how it is that children work out the conventional meanings that have to be mastered. Nor do these two principles make any direct predictions about the formation of new words by children, except to stipulate that well-established words take precedence over potential new ones that would have the same meanings (by the principle of contrast). What, then, are the principles that guide children's choices of word-forms during acquisition? And how are these acquisition principles themselves affected by conventionality and contrast? Before I take up these questions, I would like to remind you briefly of the main ways of constructing new words in English.

Word-Formation Processes in English

There are two major word-formation options in English: compounding and derivation. In compounding, speakers can combine two nouns, as in the well-established breadbasket, dogsled, or horsetrailer; or an adjective and noun, as in highchair or blackboard; or a verb and noun, as in washingmachine, breakfast, or lawnmower. Notice that the meanings of these compounds are not simply a composition of the separate parts. As speakers of English, we know that a breadbasket is a basket for putting bread in, and that a dogsled is a sled drawn by dogs, while a horsetrailer is a trailer for carrying horses. The parts of each of these compounds--horse, dog, sled, basket, etc.--have conventional meanings that must be learnt. Moreover, the relation between the constituent nouns in a compound, dog and sled say, is also a matter of convention, and as such it too has to be learnt. (Dogsled could equally well have denoted a sled for dogs to ride on (consider horsetrailer), a sled for carrying food for dogs, or a sled decorated with pictures of dogs, and so on.)

Most noun + noun compounds have either unadorned nouns joined together (usually with a characteristic primary-tertiary stress-pattern) or nouns with an -er

suffix added to the second of the two. Verbal compounds, though, come in more kinds: the verb base may be unadorned (as in breakfast) or have added nominalizing suffixes, with the verb base either in first position (such as the nominal -ing in washingmachine) or second (such as the nominal instrumental -er in lawnmower).

The second major word-formation process is derivation. There are usually said to be two kinds of derivation in English. The first is affixation where a prefix like un- or re- is added to the beginning of a base word. Or, instead of a prefix, the base has a suffix added to its end, e.g., -er (opener, leaper), -ness (greenness), -ity (activity); -y (stony), -ful (wistful); or even newly emerging suffixes like -cade, -athon, or -gate. Besides affixation, there is another very common form of derivation in English--what is called conversion or zero derivation. With conversion, the base is simply reassigned to a new part of speech with no change in form. Nouns go to verbs, verbs to nouns, and so on.

These, in brief, are the main possibilities available as regards form in constructing new words. In fact, both major word-formation processes are well illustrated in the coinages given earlier in Table 1, from adults, and in Table 2, from children. Now let me turn first to when children coin new words, and second to how they do it--some principles that guide their choices of word-forms.

Lexical Gaps

When do we adults coin new words? The answer: when we want to fill a lexical gap--that is, when we feel the need to express a meaning for which we have no conventional word already available. Gaps come in two kinds for adults: momentary and chronic. People may have to fill momentary gaps when they have trouble in retrieving the conventional word for something. For instance, imagine trying to retrieve the word for the navigational instrument that allows one to steer a course by the stars when at sea. If you fail to come up with the conventional word (sextant), you could relie on a paraphrase like the one just given, or you could construct a new word such as guider that will do for the moment in the conversation. If you then recalled sextant, however, you would most likely repair what you'd just said--"I mean, a sextant." Momentary gaps like this are not my main concern; chronic gaps are.

Chronic gaps are real gaps in the lexicon, gaps where there is no conventional word to express just that meaning. Consider this example: You want to convey to a friend that he is mistaken about which of two cars was driven by some third person on a trip to New York the day before. The cars in question are a Chevy and a BMW. You can easily convey the requisite information by coining a new verb, as in Mike CHEVIED to New York, (he didn't go in the BMW). By coining this verb, you can convey much more information than if you used drive alone because you simultaneously convey which car of the two available he drove. The same applies in the context of flying, for example, witness the attested utterance Nan Swiss-Aired to Geneva yesterday. Coinages like these are very common (Clark & Clark, 1979). Chronic gaps, then, are defined against a background of what is already in the adult lexicon.

Children also fill gaps. And like adults, these gaps may be momentary or chronic. In the former case, they know the conventional word but for some reason have a hard time retrieving it from memory. A couple of examples: one child (aged 3;2) who knew the word bed was naming pieces of toy furniture and produced sleeper for 'bed;' another child (aged 2;4) who knew the word scissors was talking

about having had a haircut. After a long word-search with ums and ahs, he came up with the word cutter instead. Here, however, my concern is with chronic gaps.

Since children's vocabularies are much smaller than the adult's, they have many more chronic gaps that may need filling. Some of their chronic gaps, of course, are those that are also gaps for adults--where the language lacks words altogether. But other gaps are gaps only for children, and not for adults. The necessary words are there; it is just that the children have not yet mastered them. There are therefore two classes of coinage in children's speech: first, those that fill real gaps: these are what I will call legitimate innovations; and second, those innovations that violate adult conventionality and contrast: I will call these illegitimate innovations. The latter actually fall into two groups--(i) those innovations whose meanings are already conventionally expressed by different word-forms (but where the word-forms coined fit the options in English and would be acceptable with other meanings), and (ii) those whose word-forms are themselves unacceptable. Each of these categories of innovation is illustrated in Table 3 (see also Clark, 1979, in press).

Table 3

Examples of Legitimate and Illegitimate Innovation

Legitimate: (form acceptable, new meaning)

to broom (= hit with a broom); to cracker (= put crackers into); to cello, piano (= play the cello, piano); to soup, tea (= eat soup, tea); to governess (= be a governess to), etc.

Illegitimate: (meanings already "taken" by other forms)

(i) with acceptable forms: to broom (sweep); to fire (burn); a lessoner (teacher); a tooth-guy (dentist); a tell-wind (weather vane), etc.

(ii) with unacceptable forms: to babysitter (babysit); to decoration (decorate); a driller (drill), etc.

Children coining new words rely on a variety of devices and word-formation processes. This is evident from the innovative word-forms in Table 3, and also from those presented earlier in Table 2. They rely on conversion to form nouns into verbs,

and also some verbs into nouns. They use affixation to construct new nouns by adding suffixes like -er or -ness. And they form numerous compounds by joining two nouns with appropriate stress. Which forms do children construct early on? And why do they pick those forms over other possible forms when they first coin new words? In answer, I propose that children rely systematically on certain principles in the acquisition of word-formation rules, and that these principles account for the choices children make, and hence for the course of acquisition they follow.

Principles of Acquisition for Word-Forms

Whenever children construct a new word to fill a lexical gap, they need to come up with a single form for a single meaning. What principles do they follow in achieving this goal? In trying to answer this question, I will be presenting something of a progress report. I have been working for some months on a large corpus of children's innovations, and from them have adduced four acquisition principles that play an important role in learning about word-formation: transparency, simplicity, regularization, and productivity. I will now take up these principles in turn, discuss some of the predictions they make, and present data in their support.

I. My first principle can be stated in the following way:

> Principle of Transparency: One-to-one matches of meaning and form are simpler and hence easier to acquire than one-many or many-one matches.

This principle makes two predictions I shall take up here. The first is that new words are more easily formed from elements with independent status, which have conventional meanings already known to children. The second is that new words are more easily formed with elements that use a single form (a known word or addition to a word) to express a single meaning. For instance, imagine a child who is trying to name the doers of various actions: it should be easier, according to this principle, for him to construct word-forms like open-man from two known words-open and man--where the conventional meaning of man is transparently relatable to the meaning 'agency,' than word-forms like opener, where the meaning of the added -er suffix is quite opaque to the child who has not yet learned the meaning it conventionally conveys. I would therefore expect younger children to rely more heavily on compounding than older ones who have learnt the meaning of the -er suffix.

What are the data? There are two sources we can turn to. The first is observations of children's spontaneous speech. And there, up to about age three, children coin many more compounds for new agents than they do -er forms. Let me give a few illustrations: from a two-year-old, rat-man for a psychologist, a colleague of the child's father; from another two-year-old, iron-man for the man who came around mending pots and pans; from another two-year-old, plant-man for the gardener; from another child the same age, letter-man for the mailman; and from another two-year-old, hand-organ-man for an organ grinder. From three-year-olds: store-man for a shop clerk, paper-man for the editor of a newspaper (the child's father), and fix-man for a car mechanic. The vocabulary studies contain a fairly large number of innovative compounds, and -man appears frequently as the second element in those designating the agents or doers of actions. Virtually no children this age coined forms with the -er suffix (Clark, 1979).

The second source of data here is elicitation studies in which we gave young children a meaning and asked them to come up with a word-form for it. (This is research I am carrying out currently in collaboration with Barbara Hecht, Robert

Morse, and Randa Mulford.) For instance, Hecht and I took three- to six-year-olds and presented them with the following request: "I have a picture of someone who hits things (hides things/gives presents, etc.). What could we call him?" Younger children were more likely to give us word-forms like hit-man, hide-man, and present-man, while slightly older children (aged four and up) were more likely to supply word-forms like hitter, hitter-man, hider, presenter, or giver. While at age three, children's -er forms made up 56% of the agent words they coined, by age four, they made up 90%. At the same time, the three-year-olds produced compounds 23% of the time, versus a bare 6% from four-year-olds (Clark & Hecht, in preparation).

In following the principle of transparency, therefore, children appear initially to opt for the following strategy:

> "Look for word-formation devices that are words in their own right and use those in constructing new words."

This is reflected in the finding that children begin by using words whose conventional meanings are already familiar to them. Later (but this is not entirely testable in English), they appear to turn to a somewhat different strategy, with the same aim.

> "Look for word-formation devices that mark only one meaning and use those in constructing new words."

With the latter comes reliance on the conventional meanings of word-formation devices themselves. For example, the nominal suffix -er conventionally has as one of its meanings 'agency' or 'doer of an action.' The earlier strategy also relies on conventional meaning--the meanings of the constituent words in the compounds children coin. Children, then, maximize on transparency by picking as the added element, whether this is a word or a word-ending, the most transparent element or device available to them at the time. And they use this element in contrast to other words or word-endings they already know.

II. Simplicity of surface form. But the most transparent elements known to children may not be the simplest when it comes to the form of the new word being constructed. This brings me to the second acquisition principle I want to consider:

> Principle of Simplicity: Simpler forms are easier to acquire than more complex ones, where simplicity is measured by the degree of change in a form. The less a word-form changes, the simpler it is.

Given the word-formation options of English, this principle makes two predictions I will take up here: (i) that children should use the process of conversion before compounding (i.e., zero change versus juxtaposition, ordering, and stress-pattern assignment); and (ii) that children should use conversion before affixation (zero change versus addition of a suffix or prefix to a base). These predictions are very general ones since they concern major word-formation processes rather than particular instances of those processes as applied to English.

What do the available data show? First, they reveal considerable tension between this principle--simplicity of form--and the principle of transparency I just discussed. Take prediction (i), that the process of conversion is mastered before compounding. The data for English show that conversion occurs very early, from

age two or even younger. Children form new verbs by conversion from nouns (e.g., to horn (= touch with a horn), to key (= open the door with a key), to paper (= cut), to hatchet (= chop), to pliers out (= remove with pliers); to bead (= put a bead into), to shirt (= to put a shirt on), to funnel (= put into a funnel), to cement (= make cement), to ballerina (= be a ballerina), to bell (= ring), etc.); from adjectives (e.g., to pink (= make things appear pink by looking at them through a piece of pink plastic), to dark (= scribble with a pencil over a drawing), to bright (= let sun shine on), to flat (= flatten), to sharp (= sharpen), etc.); and even from prepositions (e.g., to up (= raise, lift), to in (= put in), to on the lights (= turn on), to inside-out (= turn inside-out, of sweaters), etc.). They also occasionally form new nouns from verbs: a bang (for a gun), the shave (for lather), the chop (for an ax), or a sweep (for a small broom). Data like these suggest that conversion represents some form of "least effort" factor in the construction of new word-forms. The child has no change to make beyond the re-assignment to a different part of speech. The problem for prediction (i) is that compounding appears equally early in children's speech, as shown, for instance, by the typical innovative compounds in Tables 2 and 3 (e.g., plant-man (= gardener), letter-man (= mailman), cup-egg (= boiled egg), plate-egg (= fried egg), car-smoke (= exhaust), butterfly-shirt (= T-shirt with a butterfly on it), tell-wind (=weather vane), etc.).

Notice that in compounds like garbage-man, the term man is available to make the meaning of the compound that much more transparent to a child. Compare this with the change from the noun bicycle to the verb to bicycle. This change in form is a simple one, but it is far from transparent in meaning since the precise relation between this noun and verb is itself a conventional one that has to be learnt. The process of compounding, then, may be more accessible to children--easier to use--by virtue of the transparency in many well-established and innovative compounds, while the process of conversion is more accessible by virtue of the simplicity of form involved. Both principles, in different ways, make for early acquisition of the pertinent word-form types, but the principles themselves may at times be in conflict. The first prediction, then, is not borne out because of the interaction of transparency and simplicity.

The second prediction is that conversion will be used before affixation, and this prediction is strongly supported. Children freely convert nouns to verbs, on the pattern of a bicycle/to bicycle long before they construct nouns from verbs on the pattern of hit/hitter. In this case, of course, simplicity is not at odds with transparency: the -er on hitter is not initially transparent in the way the man of garbage-man is. Thus, because of the relative contributions of simplicity and transparency, conversion and compounding both appear in children's speech before affixation.

The greater complexity of affixation comes from the fact that one is adding elements to a base. Furthermore, some affixes require greater changes than others. One might therefore make a third prediction from the principle of surface simplicity, namely that the greater the number of changes produced by an affix, the later that affix should be acquired. Because -er changes a base less than -ion, then, children should acquire nominals like actor before ones like action. But this prediction is complicated by the differences in meaning that accompany -er and -ion. Instead, therefore, consider the suffixes -ness and -ity, both used to form nouns from adjectives, and near-equivalents in meaning. The first suffix, -ness, requires no change in the bases it is added to (e.g., white/whiteness, dark/darkness, pink/pinkness, etc.) and should therefore be acquired relatively early. The second suffix, -ity, on the other hand, generally requires a shift in word-stress, and often

a change in a vowel or consonant (or both) of the base as well. For instance, in the pair active/activity, the word-stress shifts from first to second syllable, while in electric/electricity, there is not only a shift in stress from the second to the third syllable, but the final /k/ of the adjective becomes an /s/ in the noun. These additional modifications should make the -ity ending harder to acquire than the -ness one.

Children's spontaneous coinages bear this out: -ness is mastered before -ity. In fact, of the two endings, I have found children coining nouns from adjectives only by means of -ness. However, I must also add one caveat: it is clear that -ity words are less likely to be used by adults to children, so this prediction needs to be tested more stringently, something better done on other languages where there are more affixes with near-equivalent meanings available for comparison.

The strategy children seem to follow in applying the principle of simplicity is the following:

> "Make as few changes as possible in forming a new word from an old one."

They apply this strategy while simultaneously observing the principle of transparency.

Children also give evidence of observing two other strategies, ones already familiar from research on the acquisition of inflections (Slobin, 1973):

> "Pay attention to the order of linguistic units."

This strategy shows up, for instance, in children's attention to the order of the elements in constructing compounds. Consider the differences in meaning of dogsled and sleddog where the second noun in each instance denotes the kind being talked about. Children do not appear to make any order mistakes with noun + noun compounds. They also appear to rely on this strategy when it comes to affixation: Children never misplace suffixes by adding them to the beginnings of words, nor do they ever put prefixes on the ends of words. They must therefore be attending to order, whether in compounds or in derived words, in the words they hear around them.

Another strategy children also seem to rely on is:

> "Pay attention to the ends of words."

This strategy shows up most clearly in the acquisition of affixes. Just as for inflections (Slobin, 1966, 1973; Kuczaj, 1979), in forming new words, children generally acquire some suffixes before they acquire any prefixes.

III. Regularization. The third principle I want to talk about, the principle of regularization, is particularly important for lessening memory load for both the speaker (in speech production) and his addressee (in speech comprehension). This principle states that:

> The paradigms (word sets) of a language are regular in form.

Why should words be regular in form? If there is a single convention--a form--for constructing agent nouns, say, then it should be much easier to remember for the

speaker who is constructing one, and also easier to recognize for the addressee who is hearing one. Regularization eases the memory load that would otherwise be imposed by learning a very large number of different word-forms. Moreover, since regularization ties particular meanings to particular forms (as in the case of the agentive -er affix), it provides ways of organizing the vocabulary being stored in memory. Regularization is directly affected by transparency (making clear what I want to say) and by simplicity (choosing the simplest way to say something).

The principle of regularization predicts that, having picked a single conventional device to express a particular meaning in constructing new words, children will use that device everywhere and thus over-regularize their language, just as they would with inflections like -ed. What do the word-formation data look like? Observations of spontaneous speech suggest that newly constructed word-forms are generally relatable to already- known, well-established terms, even where these form very small paradigms. For example, one two-year-old coined coffee-churn for a coffee grinder on the model of the known milk-churn. (The child was presumably aided in this coinage by the similarity in shape and function of the two objects in question.) Another 'small paradigm' coinage by another two-year-old is bath-tory for bathroom, on the model of the known word lavatory. The majority of coinages, though, belong to much larger paradigms such as the compound agent nouns with -man, e.g., rat-man (for a psychologist), iron-man (for a pots-and-pans mender), paper-man (for a newspaper editor), letter-man (for the mailman), or hand-organ-man (for an organ grinder). With slightly older children, newly coined agent nouns nearly all fall into the -er paradigm, e.g., crayoner (for a person who draws with crayons, in contrast to a painter), gunner (for a person who shoots with a gun), or rainer (for the person who controls whether it rains or not).

Children also form large paradigms of subkinds and here they rely almost exclusively on compounding, with the second (head) noun identifying the kind being talked about. For example, one child aged two-and-a-half talked about different kinds of smoke--car-smoke (for exhaust), house- smoke (for smoke coming from a chimney), pipe-smoke for the smoke from someone's pipe), and so on. Another two-year-old subcategorized the eggs eaten for breakfast into cup-eggs (for boiled) and plate-eggs (for fried), and a three-year-old subcategorized ships, coining wind-ship for a sailing ship in contrast to the known steam-ship. These examples, which are typical among two- and three-year-olds, rely critically on the principle of contrast in their construction. The same goes for such contrasts as bottle versus baby-bottle (for a bottle the child had drunk out of as a baby). In effect, both contrast and convention (that the first, modifying noun in a noun + noun compounds marks a subtype of the category denoted by the head noun) play important roles in such paradigmatic constructions. Both are taken into account by the principle of regularization.

Where the paradigms children use are large, there is no problem in identifying possible models children could have relied on in constructing their new word-forms. But when the paradigms are small, possibly containing only one or two members besides the child's innovation, then it is clear that the child has been very specific in his choice of a model. If this is the general case, it is simply not discernible with large paradigms. The question of the source-model has often been discussed in terms of reliance on analogy versus rule-use. By analogy, I mean the use of a single word as the model for an innovation (as in the construction of coffee-churn, based on milk-churn), and by rule-use, I mean reliance on a rule that has been induced from a set of model words all of the same structure (e.g., crayoner, tightroper, etc., from rider, driver, farmer, rancher, trucker, etc.). While strong

positions have been taken on both sides of the analogy/rule-use argument, the data on word-formation, where there is a clear continuum in the sizes of different paradigms in the language, suggest that children must rely on both processes. Indeed, analogy and rule-use themselves may simply represent the two ends of a continuum for the language learner and word coiner (see further Clark, in press).

The strategy children seem to rely on in observing regularization (one convention--one meaning, that is--per word-formation device) is the following:

> "Use the same word-formation device everywhere to mark the same meaning in forming new words."

There is additional evidence for this in our elicitation data (Clark & Hecht, in preparation). Individual children showed considerable consistency in which device they used throughout as they coined new agent nouns for us (e.g., -man or -er). This consistency, I suggest, is the result of observing a convention on the formation of new agent nouns, namely, the choice of one device with one meaning to express the notion of agency. Finally, as I have already mentioned, the data on word-formation and regularization are closely paralleled by the data on inflections from a variety of different languages.

IV. Productivity. The last principle I shall discuss is the principle of productivity. It states that:

> Those word-formation devices used most creatively in adult speech are the most productive in the language, and the most available to children.

This principle predicts that, with all other things being equal, the more productive device out of any set should be acquired before the less productive ones with equivalent or near-equivalent meanings. This principle depends very directly upon both conventionality and contrast in the following way: Because of conventionality, when children come to create a new agent noun, say, they look for just one form appropriate to forming that kind of noun. And because of contrast, if there are two forms used to mark agents, they assume (until they learn more later) that there must be two kinds of agents at issue. They therefore pick out just that form whose added element is the one used by adults with the same aim, namely constructing a new agent noun. In general, this will also be the most frequent ending, reflecting regularization, and the most transparent one, i.e., it means the same thing each time (a one-to-one mapping). In fact, since the one-to-one mapping should make it more transparent to adults as well, that in turn would further increase the productivity of the form.

The effects of productivity on acquisition can be assessed both within and across languages. Let me first illustrate an instance of productivity within a language. Consider three agentive suffixes used in English:

(i) -er, as in farmer, baker, writer, gardener, etc.

(ii) -ist, as in bicyclist, artist, chemist, etc.; this suffix is undoubtedly rarer than -er in speech to children.

(iii) -ian, as in librarian, Shakespearian, or Chomskyan; another suffix that is rare in speech to children.

The most productive of these endings is -er, and of the suffixes expressing agency, it is the only one attested in children's spontaneous coinages, e.g., crayoner, lessoner, lightroper, rainer, etc. It is also the only one children offered in our elicitation studies, e.g., hider, opener, hitter, burner, jumper, etc. (Clark & Hecht, in preparation). The most productive agentive suffix in English, then, is also the first agentive ending used by children constructing new agent nouns.

The findings for French parallel the English example exactly. French has a variety of agentive suffixes, e.g., -ier, -eur, -iste, -ien, and -aire. The two most productive are -ier and -eur, and these two suffixes are the only ones to appear in young children's coinages. The suffix -ier appears in coinages like cersonnier for a mender of hoops, based on cerceau (hoop); marronnier for a seller of chestnuts, based on marron (chestnut); or Monsieur Bâtier for a child wearing socks, based on bas (sock, stocking). And -eur appears in coinages like crêmeur for an eater of cream, from crême (cream); ouvreur for an opener (a role in a game), from ouvrir (to open); or preneur for a taker (another role), from prendre (to open). In both English and French, then, the more productive of the devices used to express agency are the devices acquired earliest by young children.

The effects of productivity can also be examined across languages, with a two-fold prediction. First, the presence of a productive device to convey some meaning should be reflected in children's spontaneous coinages, and second, the virtual absence of any productive device to convey that same meaning in another language should likewise be reflected in children's speech, this time by the virtual absence of coinages dependent on that meaning. As an illustration, consider the case of negative verbs, verbs whose meaning is "reversal of the action named", in three languages: English, French, and German.

In English, there is a highly productive device denoting reversal of action, namely the prefix un-. The prefix is acquired relatively early by small children, and is used very frequently to construct verbs denoting reversals of action. Here are a few representative examples from my own data and from Bowerman (1979): unclothes (to undress), uncrowd (to make less crowded by removing some toys), undead (to make alive again), unparcel (to undo a parcel), unzipper (to unzip), and so on. Like English, French also has a very productive prefix for indicating reversal of action, namely, dé- (dés- before vowels). And, as in English, this prefix is acquired early and used in a large range of coinages by young children. The following innovations are typical: débâtir (to unbuild, demolish), déchauffer (to unwarm), défatiguer (to untire, make not tired), and développer (to unwrap, the opposite of envelopper). But, unlike English and French, German lacks a productive device for indicating reversal of action. There is no single prefix or suffix (or particle) that is used productively with this particular meaning. The result: Children acquiring German coin very few negative verbs (unlike children acquiring English or French). And on the rare occasions when they do construct a negative verb, they do not use any one device consistently. There is a gap in German, then, which appears to be directly reflected in the paucity of children's innovative verbs with reversative meaning (see further Clark, 1980).

The strategy children seem to use when they observe productivity is something like the following:

> "Look for the commonest device that expresses the desired meaning and use that in constructing a new word-form."

But, in following this strategy, children don't observe frequency pure and simple. They look for devices that have a single convention (single meaning), and devices, moreover, that are also transparent. The most transparent device available is often the most regular one too. The child wishing to express agency finds out that the addition of -er is the conventional means for doing this; it is also the most productive device of the several available. By choosing the conventional way to form new agent nouns, and then contrasting that device (in this instance, the -er suffix) with other word-formation devices, the child assumes that adults too rely on one device to form new agent nouns. Similarly, if he wants to convey a particular action associated with some object, he can rely on the process of conversion to construct a new verb. Again, this is the conventional way to form such verbs, and it is also the most productive way available to speakers of English.

In summary, I have identified four acquisition principles that appear to guide children in their construction of new word-forms to convey new meanings. In doing this, I have tried at the same time to show how the acquisition principles themselves are affected by children's early observance of the more general principles of conventionality and contrast. It is crucial in this type of study to look at children's lexical innovations. In using well-established words, children can simply use the forms they have picked up wholesale, with no regard for their internal structure. It is only when coining new words that children have actively to construct new forms to carry their meanings.

Goals of this Research

Let me conclude with a list of some of the goals I would like to achieve with this research. Some of them are long-term ones, others may be achieved more immediately:

1. Give an account of what goes on in the process of acquisition.

In the domain of word-formation research, this can be subdivided into various more manageable goals--or ones that seem to be so:

(a) To chart the order of acquisition of different word-form types, and children's mastery of the conventions governing their use, for instance that -er in English marks agency, and not location or manner, that -ly, in contrast, marks manner, and so on.

(b) To find out whether there are constraints on the kinds of meanings that are conveyed by children's innovations. (In the present paper, I have focussed primarily on the principles that guide children's choices of word- forms for innovations, but my research in this area stems equally from concern with the meanings of lexical innovations (e.g., Clark, in press).)

(c) To chart the emergence of children's knowledge about when it is possible and appropriate to coin new words. This requires learning conventions on the process of innovation itself--namely, making sure your addressee will know enough from his a priori knowledge (of you and of the topic), from the context, and from your mutual knowledge, to be able to compute the meaning intended by you, the speaker, in using an innovation. (Again this is a topic I have neglected here, but it is one I have discussed in detail elsewhere (Clark & Clark, 1979; Clark, in press).)

2. Identify the principles and strategies children rely on in the course of mastering the word-formation options in their first language.

Are transparency, simplicity, regularization, and productivity the only principles at work? What further principles are needed to account for the course (or courses) children follow in the acquisition of word-formation? To answer these questions will require examination of data from a variety of languages, preferably languages with different patterns of word-formation and productivity, and preferably data both from spontaneous coinages and from elicitation studies to find out exactly what children do and don't know about word-formation at different stages. This is a project I am currently engaged in.

How do the different principles interact with each other, or with such general principles as conventionality and contrast? Do some principles carry greater weight than others at particular points in acquisition? How is each one affected by what children already know? Answers to these questions require much more analysis than I have done yet, and will probably require data from many more languages too.

3. Find out whether the principles identified so far also account for the facts of acquisition in other languages of different structure, with different instantiations of word-formation processes.

This goal will require comparisons of word-formation acquisition in different types of languages, e.g. Indo-European versus Semitic languages, or versus ASL. Here I am still in the planning stage.

4. Use the domain of word-formation itself to make more detailed analyses of the process of acquisition for other domains such as syntax.

There are several reasons why I think this feasible and likely to provide some useful insights into language acquisition generally. First, word-formation is much more manageable domain in many respects than syntax: it allows close study of the processes involved as well as easy elicitation of what can be very rare events in a domain like syntax. (Indeed, syntactic constructions are notoriously hard to elicit, so the observer is often forced to be content with spontaneous speech alone.) Second, word-formation (whether in the form of spontaneous or elicited innovations) has the advantage of dealing with meaningful units, units that "make sense" to the young speaker. This is notably unlike the setting presented by reliance on nonsense words. Indeed, studies of inflections have always shown a decline in children's performance from real to nonsense items; unfortunately, this difference is always confounded with unfamiliarity as well.

5. Account for the kinds of meanings coined by children. Here I have three questions I would like to be able to answer: (i) Do children acquiring different languages coin words with similar kinds of meanings? (Since children can't know ahead of time where the chronic adult gaps are, they cannot simply be trying to fill those.) (ii) What relations are there between the meanings children express, via innovations, and those children's cognitive development? And (iii), are the kinds of meanings expressed all meanings that are represented in the adult language? Are these meanings at least represented in other languages? Or are they idiosyncratic to the particular child who coined them?

Conclusion

This programmatic account of my current concerns in the study of language acquisition is essentially a progress report. When I began my research on word-formation, my main interest was in the meanings expressed--and this followed fairly naturally from my earlier research--but I hope I have convinced you that word formation can also reveal a great deal about, first, the acquisition of forms, and second, about the relationships between meanings and forms--that is, the forms chosen for the meanings they can conventionally express. Third, and last, I hope to have convinced you that the findings from word-formation may well provide us with insights into the acquisition of other kinds of linguistic structure as well as into the inter-play of convention and innovation in the lexicon.

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